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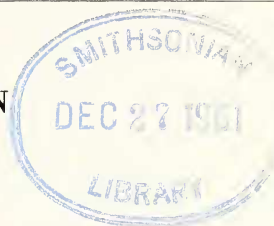
NUMBER 47

DECEMBER 21, 1961

THE MACHRIS BRAZILIAN EXPEDITION

BOTANY: A New Brazilian *Begonia*

By LYMAN B. SMITH¹ AND BERNICE G. SCHUBERT²



The present paper is a continuation of studies of the plant collections made by E. Yale Dawson on the Machris Brazilian Expedition of 1956 from the Los Angeles County Museum and the Museu Nacional do Brasil. A distinctive *Begonia* was successfully flowered after several years cultivation and is described here as

Begonia machrisiana Smith & Schubert sp. nov.

Fig. 1

Herbacea, caulescens, erecta, 25-30 cm. alta, utrinque pallide stellato-lanata; foliis peltatis, suborbicularibus vel ample reniformibus, ad 16 cm. latis, obtuse sinuato-dentatis, petiolo ad 55 mm. longo, stipulis late ovatis, margine sinuatis, 23 mm. longis, intus glabris; scapis ad 17 cm. longis; cymis subdensis, 6 cm. diametro; bracteis deciduis, ellipticis, ultra 7 mm. longis; pedicellis masculinis ad 17 mm. longis, femineis brevibus; tepalis extus stellato-pilosis, masculinis 2, orbicularibus, 14 mm. diametro, albis; staminibus in columna brevi insertis, antheris ellipticis, filamenta subaequantibus, connectivo obtuso producto; floribus femineis ebracteatis; tepalis femineis 6, valde inaequalibus, majoribus juvenilibus 8 mm. longis, late ovatis, obtusis, minoribus suboblongis, extimis dorso lanatis, intimis omnino glabris; stylis 3, subliberis, quorum binis regulariter bifidis, tertio irregulariter multifido; ovario tripartito, alis inaequalibus, subdeltoideis.

TYPE: E. Yale Dawson 14675a, under an overhanging rock in the canyon bottom west of the road, 14 km. south of Veadeiros, Goias, Brazil, April 25, 1956, collected as a living plant and flowered after four years' cultivation by M. A. Machris in Santa Monica, Calif.

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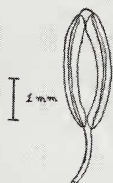
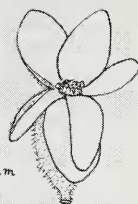
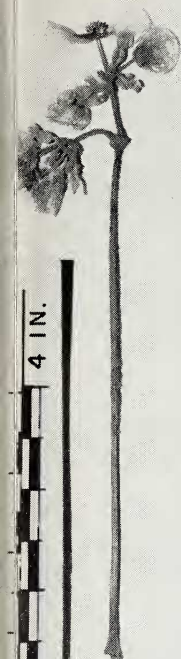
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The technical type specimen is deposited in the Museu Nacional do Brasil. An isotype, represented by a leaf and flowers, is in the Los Angeles County Museum.

Begonia machrisiana seems to have no very close relatives. For the present it seems logical to assign it to Sect. *Begoniastrum*. When more material is collected the relationships of the species may be better clarified. The peculiar combination of characters which distinguish *B. machrisiana*, two staminate and six pistillate tepals, two regularly bifid styles and one multifid, together with peltate leaves are found in no other species known to us. The only Brazilian species which approaches *B. machrisiana* superficially, *B. umbraculifera* Hook. f., is quite distinct, although it may be a member of the same section. It has two staminate and five pistillate tepals and peltate, but glabrous leaves, and is in fact completely glabrous while *B. machrisiana* has distinctive stellate pilosity almost throughout.



Fig. 1. *Begonia machrisiana* Smith & Schubert. The holotype specimen. Photo courtesy Smithsonian Institution.



PLANTS OF GOIAS, BRAZIL
MACHRIS BRAZILIAN EXPEDITION

Beconia machrisiana Smith & Schubert
holotype

col. by E. Yale Dawson n. 14675a, Apr. 25, 1955

Growing under an overhanging rock in the canyon bottom west of the road, 14 km. south of Veadeiros, Goias. Living plants were returned for cultivation by E. A. Machris in Santa Monica, California. After 4 years a specimen from which the type was prepared flowered in February, 1961.

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NUMBER 48

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THE ECHINOID *MELLITA* IN THE PACIFIC COAST CENOZOIC

By J. WYATT DURHAM



CONTRIBUTIONS IN SCIENCE is a series of miscellaneous technical papers in the fields of Biology, Geology and Anthropology, published at irregular intervals by the Los Angeles County Museum. Issues are numbered separately and numbers run consecutively regardless of subject matter. Number 1 was issued January 23, 1957. The series is available to scientists and scientific institutions on an exchange basis. Copies may also be purchased at a nominal price.

DAVID K. CALDWELL

Editor

E. YALE DAWSON

Associate Editor

THE ECHINOID *MELLITA* IN THE PACIFIC COAST CENOZOIC

By J. WYATT DURHAM¹

Species of the "keyhole urchin" *Mellita* are common members of the shallow water faunas of the New World tropics and also occur in warm temperate areas of the western Atlantic. On the Pacific coast they are known to be living from the head of the Gulf of California to Ecuador (Mortensen, 1948, p. 428). H. L. Clark (1948, p. 337, pl. 62, fig. 60) has recorded *Mellita* from as far north as San Juanico Bay (26° 15' N. lat.) on the west coast of Baja California.

In California an incomplete "keyhole urchin" from the middle Miocene was referred with some doubt to the genus *Mellita* by Grant and Hertlein (1938, pp. 102-103). Examination of the specimen upon which the record was based shows that on the oral surface it has the pores for the secondary tube feet adjacent to the food grooves arranged in linear zones, somewhat similar to the "combs" of the Arachnoididae of the Indo-Pacific. This character, also observable on well preserved specimens referable to *Scutaster*, along with the greatly elongate basicoronal interambulacral plates, indicates that this specimen, despite its narrow, radially elongate lunules, is referable to *Scutaster* or some closely allied undescribed genus.

After elimination of the above record, all known occurrences of the genus are in the Pleistocene and Recent (Caso, 1951, p. 74; Cooke, 1959, p. 46; Kanakoff and Emerson, 1959, p. 21). In view of its occurrence only in the tropical and warm temperate areas of the western Atlantic and eastern Pacific, it is evident that *Mellita* must have a fossil record extending back to at least the upper Miocene when the Central American seaways were open (Durham and Allison, 1960, pp. 66-67), permitting migration from the Panamic to the Caribbean area or vice versa. Thus it may be expected to occur as a fossil in the Miocene and Pliocene of the Neotropical region.

H. L. Clark (1940) reviewed the Atlantic members of the genus separating a new species (*M. lata*) and a new variety (*M. quinquesperforata tenuis*) from the morphologically diverse forms that have been referred to *Mellita quinquesperforata* Leske. Mortensen (1948, pp. 422-427) did not feel that this separation was warranted, and Cooke (1959) has ignored *M. lata*. However, the nearly constant and distinct morphological types represented in the collections of the Museum of Paleontology of the University of California from different localities in the Caribbean region strongly suggest that Clark's segregations are well warranted and that probably additional taxa should likewise be recognized. A few large collections from single populations suggest that the amount of variation for a species in this genus is relatively small.

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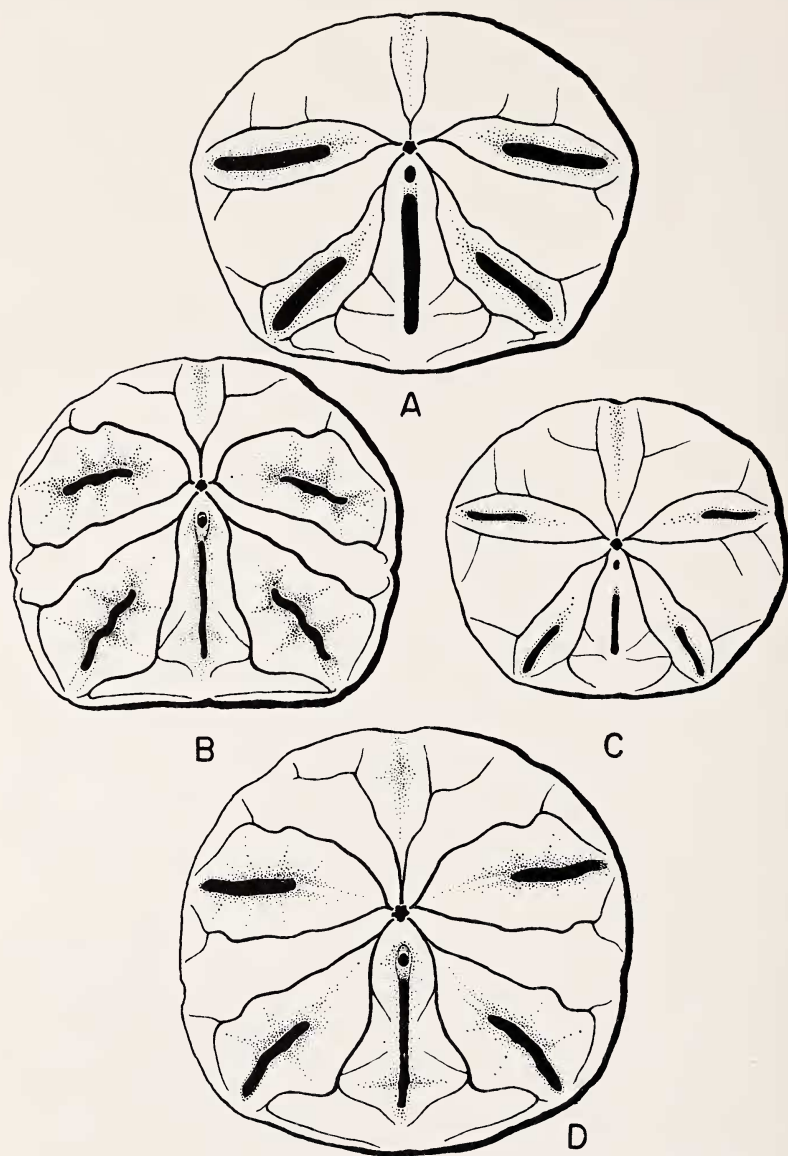


Fig. 1. Oral surfaces of *Mellita* spp. A, *Mellita longifissa* Michelin, approximately $\times 1$ (after Caso, 1946, fig. 10); B, *Mellita notabilis* H. L. Clark, $\times 0.75$, hypotype UCMP no. 34686, UCMP locality A-3986; C, *Mellita grantii* Mortensen, composite figure after hypotypes UCMP nos. 34685 and 34688, UCMP locality A-6600; D, *Mellita kanakoffi* n. sp., $\times 0.75$, holotype LACM no. 1123, LACM locality 66-2.

In the eastern Pacific, *Mellita longifissa* was described by Michelin in 1858 and has been considered to be the most common living species in the Pacific. In 1947, H. L. Clark described a new species, *Mellita notabilis*, based on a specimen that was reported to be from Florida, but noted (1947, p. 78) that it "... probably comes from the western coast of Central America." Comparison of the type with specimens from the west coast of Central America indicate that they represent the same species and confirm Clark's inference as to its origin. In 1948 Mortensen described *M. grantii*, a species that has been recorded only from localities in the head of the Gulf of California as far south as Las Animas Bay. The species first recorded by Kew (1920) as referable to *M. longifissa* from the Pleistocene of Newport Beach, California, is actually distinct from all the above Pacific Coast species. During the last few years Mr. George P. Kanakoff of the Los Angeles County Museum has collected a large suite of specimens of this distinctive Pleistocene species from the Wilmington and Newport Beach areas of California. It is here described as new. The other, living, Pacific Coast species are reviewed. Thanks are due Mr. Kanakoff for the opportunity to study the material collected by him. The illustrations have been prepared with the aid of funds supplied by the Committee on Research of the University of California (Berkeley).

Genus *Mellita* L. Agassiz

Mellita L. Agassiz, 1841, Mon. d'Echin., Sec. Mon., Des Scutelles, p. 34; Mortensen, 1948, Mon. Echin., vol. 4, pt. 2, pp. 420-422; Durham, 1955, Univ. Calif. Pub. Geol. Sci., vol. 31, p. 172.

Type Species: *Echinodiscus quinquesperforatus* Leske

Mellita kanakoffi n. sp.

Pl. 2, fig. 2; Text fig. 1 D

Mellita longifissa Michelin, Kew, 1920, Univ. Calif. Publ. Bull., Dept. Geol., vol. 12, pp. 137-138, pl. 38, figs. 1a-1e. *Non* Michelin, 1858.

Mellita longifissa Michelin n. var. Israelsky, 1923, Univ. Calif. Publ., Bull. Dept. Geol. Sci., vol. 14, p. 382, pl. 70, fig. 2, pl. 71, fig. 2, pl. 72, fig. 1.

?*Mellita longifissa* Michelin, Mortensen, 1948, Mon. Echin., vol. 4, pt. 2, atlas, pl. 58, fig. 5. *Non* Michelin, 1858.

Mellita new sp. Durham, in Kanakoff and Emerson, 1959, Los Angeles Co. Mus., Contrib. in Science, no. 31, p. 21.

Medium to large size (length up to 105.5 mm.); outline of test rounded to pentagonal, never markedly wider than long; margin thin; greatest thickness anterior to apical system; anterior paired lunules as long as posterior pair, about at right angles to anterior-posterior axis of test; posterior paired lunules aligned approximately along continuation of axis of petals; anterior petal longer than anterior paired petals and nearly as long as posterior paired petals; apical system median to slightly anterior; posterior lunule long and narrow; peristome slightly anterior; lunules with slight lateral troughs leading into them on oral surface, the food grooves markedly bifid as typical for genus, the two principal trunks

near margin of each ambulacral area distinct from lunules, markedly sinuous; periproct at anterior end of, and rather deep within, posterior lunule.

DIMENSIONS: Holotype (Los Angeles County Museum no. 1121), length 73.3 mm., width 77.1 mm., height 11.0 mm.; paratype (L.A. Co. Mus. no. 1122), length 105.5 mm., width 107.2 mm., height 16.2 mm.

TYPES: Holotype, Los Angeles County Museum no. 1121; L.A. Co. Mus. loc. no. 66-2; paratype, Los Angeles County Museum no. 1122; L.A. Co. Mus. loc. no. 77; paratype, Univ. Calif. Mus. Paleo. no. 11025 (Kew's specimen); paratype, Univ. Calif. Mus. Paleo. no. 31181 (Israelsky's specimen, formerly numbered 30591); paratype, Calif. Acad. Sci. no. 12368 (CAS. loc. 17946).

TYPE LOCALITY: Upper Pleistocene, Palos Verdes sand, second bed from the top gully in Dry Creek of eastern end of Newport Bay Estuary, $\frac{1}{4}$ mi. south of salt-reducing plant of Irvine Estate (Los Angeles County Museum Invertebrate Paleontology loc. 66-2).

DISTRIBUTION: Pleistocene of Newport Beach, Calif. (Kew, 1920; Israelsky, 1923); Upper Pleistocene, type locality, 7 specimens; Upper Pleistocene, Palos Verdes sand sewer outfall excavation at corner of Lomita Boulevard and Main Street, Wilmington, California (Los Angeles County Museum Invertebrate Paleontology loc. 77), 27 specimens; Recent, Piedra Blanca Bay, Costa Rica (Calif. Acad. Sci. loc. 17946, one specimen).

COMPARISONS: *M. kanakoffi* differs from *M. longifissa* Michelin (see Caso, 1946, figs. 8-10, as well as Michelin's original figures reproduced in Grant and Hertlein, 1938, pl. 21, figs. 1-3) by the anterior lunules being approximately equal in length to posterior paired lunules and not being inclined posteriorly to the axis of the test; by the markedly sinuous instead of gently curved main branches of the food grooves that are distant from, instead of close to, the sides of the paired lunules. *M. grantii* Mortensen has the anterior petal slightly longer than the posterior petals, the main branches of the food grooves only gently curved and close to the sides of the paired lunules, as well as the greatest height of the test coinciding with the apical system. *M. notabilis* H. L. Clark has anterior lunules that are shorter than the posterior paired lunules and posteriorly inclined to the axis of the test. The two specimens recorded by Kew and Israelsky fall within the limits of variation of the collections made by Kanakoff.

The Recent specimen from Piedra Blanca Bay, Costa Rica (Calif. Acad. Sci. loc. 17946), is associated with a specimen of a typical *M. longifissa*. It does not seem to differ from the numerous fossils in any significant manner. The Recent specimen (from Ecuador?) figured by Mortensen (1948, atlas, pl. 58, fig. 5), insofar as can be determined from the aboral surface, is also referable to this species, but the oral surface should be examined.

The Recent occurrences of *M. kanakoffi* in tropical faunas is in accord with the conclusion of Kanakoff and Emerson (1959, pp. 33, 42-43) that

the Newport Bay Pleistocene fauna requires "a warmer hydroclimate . . . than exist[s] in this region at the present time".

***Mellita notabilis* H. L. Clark**

Pl. 1, fig. 2; Pl. 2, fig. 1; Text fig. 1 B

Mellita notabilis H. L. Clark, 1947, Bull. So. Calif. Acad. Sci., vol. 46, pp. 77-78.

Clark's description is inadequate in terms of the criteria used in this paper, so the following description, based on additional specimens, is presented: medium size; outline of test rounded but truncated posteriorly; margins thin; greatest thickness anterior to apical system; anterior paired lunules shorter than, and usually about three-fourths length of posterior paired lunules, inclined posteriorly from axis of test; posterior paired lunules aligned approximately along continuation of axis of petals and slightly arched towards axis of test; anterior petal only slightly longer than anterior paired petals; anterior paired petals about two-thirds length of posterior paired petals; apical system usually about five-twelfths length of test from anterior end; posterior lunule long and narrow; peristome anterior; periproct close to peristome, within anterior end of posterior lunule; paired lunules on oral surface with strongly developed lateral troughs leading into them, giving a sinuous aspect to lunule; food grooves markedly bifid as for genus; two principal trunks near margin of each ambulacral area, distant from lunule and markedly sinuous, with well developed branch parallel to posterior margin in area between posterior paired lunules.

DIMENSIONS: Holotype, length 70 mm., width 78 mm., height 10 mm.

TYPES: Holotype, Los Angeles County Museum no. 1123; hypotypes Univ. Calif. Mus. Paleo. nos. 34686, 34687; hypotype, Calif. Acad. Sci. no. 12367 (C.A.S. loc. 27226).

TYPE LOCALITY: Reported by Clark (1947), with some doubt, as Florida. The other specimens now available seem to indicate, as suggested by Clark, that the type was from the west coast of Central America.

DISTRIBUTION: Recent, type locality, west coast of Central America (?); Recent, Univ. Calif. Mus. Paleo. loc. A3986, Pacific Coast of El Salvador; Recent, Corinto, Nicaragua, Calif. Acad. Sci. loc. 27226 (one specimen), in association with typical *M. longifissa*.

COMPARISONS: See under *M. kanakoffi*. The shorter and posteriorly inclined anterior lunules, the sinuous food grooves distant from lunules, marked lateral grooves to lunules on the oral surface, and prominent posterior marginal branch of food grooves characterize this species.

***Mellita longifissa* Michelin**

Pl. 1, fig. 1; Text fig. 1 A

Mellita longifissa Michelin, 1858, Rev. et Mag. de Zool. Pure et Applique, ser. 2, vol. 10, pp. 360-361, pl. 8, figs. 1a-1c; Grant and Hertlein, 1938, Publ. Univ. Calif. Los Angeles, Math. and Phys. Sci., vol. 2, pp. 101-102 (in part), pl. 21, figs. 1-3; Caso, 1946, An. Inst. Biol. Méx., vol. 17, nos. 1-2, pp.

254-258, figs. 7-10; Mortensen, 1948, Mon. Echn., vol. 4, pt. 2, pp. 427-428 (in part, *non* pl. 58, fig. 5); Clark 1948, Univ. So. Calif. Publ., Allan Hancock Pacific Exped., vol. 8, pp. 337-338, pl. 62, fig. 60. *Non* Kew, 1920, Israelsky, 1923.

Specimens unmistakably identifiable as this species seem to be rare in most collections. Mortensen (1948) and H. L. Clark (1948) each had two specimens. Caso (1946, p. 258) reports 30 specimens from Playa San Benito, Tapachula, Mexico. The California Academy of Sciences has only six specimens from four localities. The inclusion of specimens representing the four Pacific Coast species here recognized under *M. longifissa* probably accounts for Grant and Hertlein's (1938, p. 102) statement: "The species is apparently quite variable."

Using the criteria adopted in this paper, *M. longifissa* is characterized by: apical system slightly anterior, the peristome even more anterior in large specimens; anterior paired lunules about as long as posterior paired lunules, inclined posteriorly; anterior petal slightly longer than anterior paired petals and shorter than posterior petals; lunules on oral surface without marked lateral troughs; primary branches of food grooves not markedly sinuous or angulated and close to margins of lunules; main food grooves in ambulacra Ia and Vb without well-developed branch parallel to posterior margin.

The lack of lateral troughs leading into the lunules on the oral surface, the primary branches of the food grooves close to the lunules and the lack of the secondary branch parallel to the posterior margin of the test seem to be the most diagnostic characters of *M. longifissa*.

HYPOTYPE: Calif. Acad. Sci. no. 12369, from Calif. Acad. Sci. loc. 27230.

TYPE LOCALITY: Unknown, presumably west coast of the Americas.

DISTRIBUTION: As here characterized, this species is known to occur in the Recent fauna at: Piedra Blanca Bay, Costa Rica (Calif. Acad. Sci. loc. 17946, one specimen); Petatlan Bay, Guerrero, Mexico (Calif. Acad. Sci. loc. 27230, two specimens); Mazatlan, Mexico (Calif. Acad. Sci. loc. 27233, one specimen); Corinto, Nicaragua (Calif. Acad. Sci. loc. 27266, three specimens); Playa San Benito, Tapachula, Chiapas, Mexico (Caso, 1946, p. 258, 30 specimens); San Juanico Bay, west coast of Baja California (Clark, 1948, p. 337, two specimens).

Mellita grantii Mortensen

Pl. 1, figs. 3, 4; Text fig. 1 C

Mellita grantii Mortensen, 1948, Mon. Echin., vol. 4, pt. 2, pp. 428-429, pl. 15, fig. 3, pl. 59, figs. 4-5; Mortensen, 1949, Vidensk. Medd. Naturk. Foren, Kobj., vol. 111, p. 72.

Specimens of this species were questionably included under *M. longifissa* by Grant and Hertlein (1938, p. 102) and later were described as new by Mortensen. It is seemingly very distinct from the other west coast species of the genus and may be endemic to the northern part of the

Gulf of California. It may be characterized as follows: Test small to medium size; outline rounded, not posteriorly truncated; apical system central, coinciding with maximum height; paired lunules small, about equal in size, distant from ends of petals and close to ambitus; anterior paired lunules about at right angles to axis of test; posterior unpaired lunule short and narrow, the anterior end terminating close to line connecting distal end of posterior petals; petals small; length of paired petals about one-third radius of test; anterior petal longest, other subequal; paired lunules on oral surface without lateral troughs; periproct about midway between anterior end of posterior lunule and peristome; peristome small, nearly central; food grooves simple, the main branches close to sides of lunules, well inside edges of ambulacral areas; no well developed secondary branch close to, and parallel with margin in ambulacra Ia and Vb.

The immature specimens show the ambulacral lunules starting as indentations on the margin, closing at a length of 24 to 28 mm.

DIMENSIONS: of largest specimen (hypotype, Univ. Calif. Mus. Paleo. no. 34684), length 51.7 mm., width 55.1 mm., thickness 6.8 mm.; next largest specimen (hypotype, Univ. Calif. Mus. Paleo. no. 34685), length 46.3 mm., width 51.7 mm., height 7.3 mm.

TYPE LOCALITY: San Felipe, Baja California.

DISTRIBUTION: Recent, head of Gulf of California, region around San Felipe (Univ. Calif. Mus. Paleo. loc. A-6600, about 100 specimens, from 9 mm. length to maximum recorded; Univ. Calif. loc. A-6904, Ensenada Blanca, 9 specimens); Las Animas Bay, east coast of Baja California (Univ. Calif. Mus. Paleo., loc. A-3639, 2 specimens).

The central apical system, long anterior petal and short lunules readily separate this species from other members of the genus.

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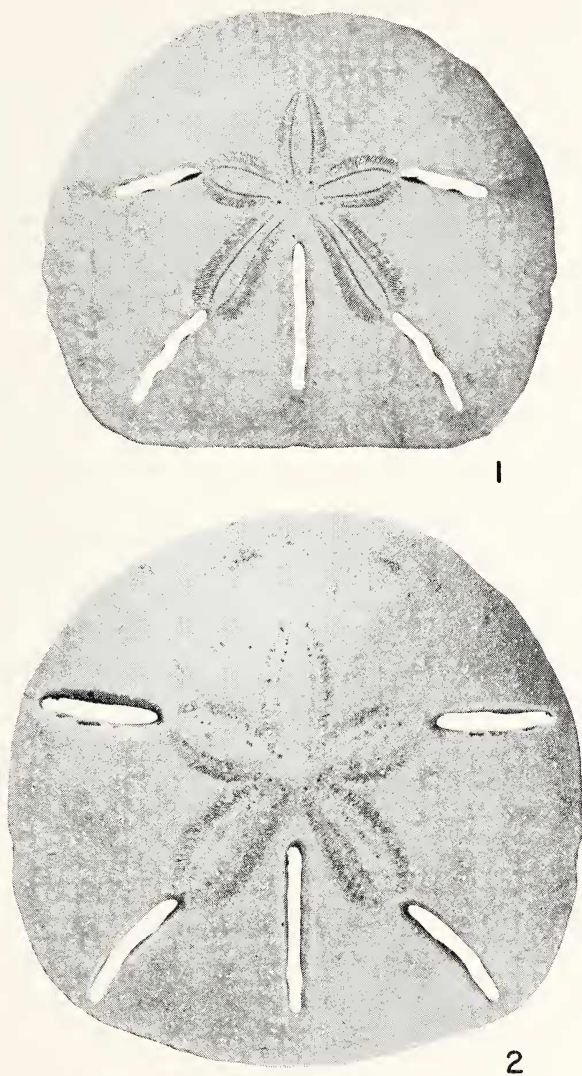


PLATE 1

Fig. 1, *Mellita longifissa* Michelin, $\times 0.5$, hypotype Calif. Acad. Sci. no. 12369, locality 27230. Fig. 2, *Mellita notabilis* H. L. Clark, $\times 0.62$, holotype LACM no. 1123. Fig. 3-4, *Mellita grantii* Mortensen, $\times 1.1$ UCMP locality A-6600, Fig. 3, hypotype UCMP no. 34688; Fig. 4, hypotype UCMP no. 34685.

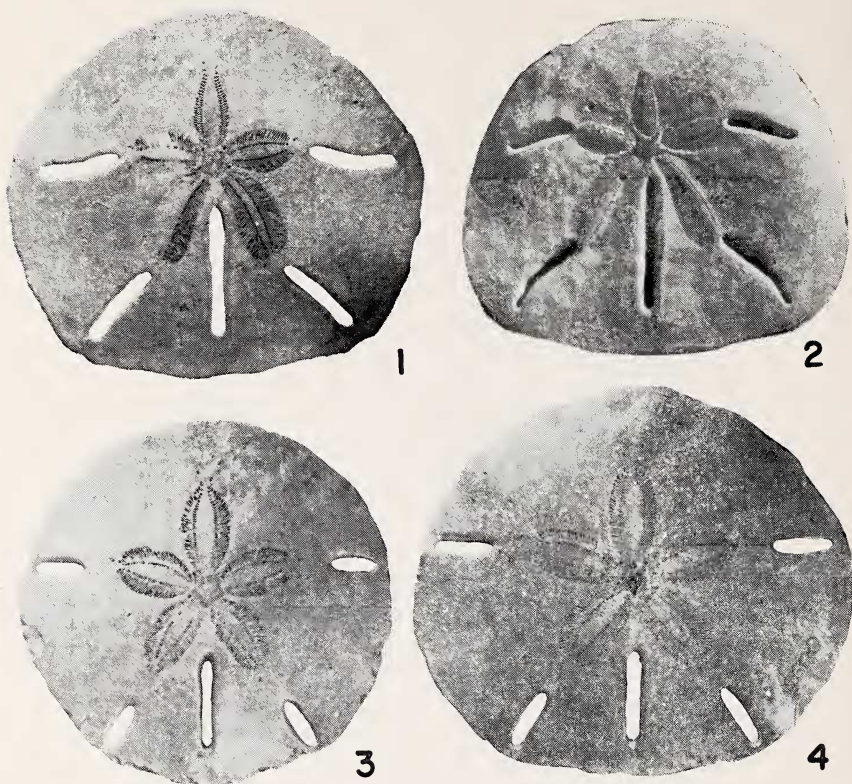


PLATE 2

Fig. 1, *Mellita notabilis* H. L. Clark, $\times 0.5$, hypotype UCMP no. 34686, UCMP locality A-3986. Fig. 2, *Mellita kanakoffi* n. sp., $\times 0.65$, holotype LACM no. 1121, L. A. Co. Mus. locality 66-2.

Erratum:

Figures of Plates 1 and 2 are reversed.

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NUMBER 49

FEBRUARY 26, 1962

A NEW SPECIES OF SALAMANDER FROM COLOMBIA AND THE STATUS OF *GEOTRITON ANDICOLA* POSADA ARANGO

By DAVID B. WAKE¹ AND ARDEN H. BRAME, JR.²

Emmett R. Dunn, in the addenda to his monograph of the family Plethodontidae (1926), briefly discussed six salamander specimens located in the British Museum (BM) that he assigned to *Oedipus platydactylus* (= *Bolitoglossa platydactyla*). Three of these, one from San Carlos, Costa Rica, and two from Medellín, Colombia, are of interest since the localities are far south of the known range of *B. platydactyla* (southern Mexico and northern Central America). Dunn stated that the San Carlos specimen "is certainly *platydactylus* rather than any other described form," but he also mentioned deviation in the color pattern from typical *platydactyla*. He discussed the coloration of the Medellín specimens and concluded that "These may represent an undescribed form, but as with the San Carlos specimen they are *platydactylus* rather than any other known species." We have recently examined the material discussed by Dunn in conjunction with our studies of the plethodontid salamanders. The Costa Rican specimen closely fits the description of *Bolitoglossa alvaradoi* described by Taylor (1954) and we assign it to that species. The Medellín specimens differ markedly from both *B. platydactyla* and *B. alvaradoi* and doubtless represent an undescribed species. In reference to the characteristic color pattern we propose that it be known as:

*Bolitoglossa phalarosoma*³, new species

Fig. 1

Oedipus platydactylus (part), Dunn, 1926: 440.

HOLOTYPE: BM 97.11.12.22; an adult female from Medellín, Depart-

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²Student Professional Worker, Los Angeles County Museum, and Department of Biology, University of Southern California.

³From the Greek, *phalaros* (having a white patch) and *omos* (shoulder).

SMITHSONIAN
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mento de Antioquia, Colombia, collected by a Mr. Pratt. The altitude of Medellín is 5,045 feet (1538 m.).

PARATYPE: BM 97.11.12.21; a male, same data as holotype.

DIAGNOSIS: A medium-sized species distinguished from all other South American salamanders by: flattened, fully webbed feet (Fig. 1); head narrower relative to body length than in other species; moderate numbers of maxillary teeth; and a characteristic color pattern consisting of a uniform dark ground color spotted along the sides of the head and over the shoulders by two series of large white patches (Fig. 1). The nearest relative is *B. alvaradoi* of Costa Rica, a larger species having a wider head, longer limbs and more maxillary teeth.

DESCRIPTION OF THE HOLOTYPE, adult female: snout moderately long, blunt tipped; nostril small, the labial protuberances moderate; canthus rostralis arched, poorly defined. Snout-vent length 8 times head width, 4.8 times snout-gular fold length; postorbital groove indistinct, extending posteriorly from eye as small depression for 3.6 mm., sharply proceeding ventrally and extending across gular area parallel to and 4.8 mm. anterior to gular fold. Vomerine teeth 12-11, extending to lateral border of internal nares. Maxillary teeth 20-23, extending posteriorly nearly to posterior border of eye. Two premaxillary teeth, not piercing lip. Tail missing. Post-iliac gland very poorly indicated. Limbs short, allowing four and one-half costal folds to remain uncovered when appressed to sides of trunk; snout-vent length 5.4 times right fore limb, 4.8 times right hind limb. Webbing of hand and foot (Fig. 1) complete; digits flattened, the tips of longer digits extending as small pointed tips from webbed pad. Fingers in order of decreasing length: 3,2,4,1; toes in order of decreasing length: 3,4,2,5,1.

Measurements in millimeters: Head width 7.3; snout-gular fold (head length) 12.2; head depth at posterior angle of jaw 3.6; eyelid length 3.3; eyelid width 1.6; anterior rim of orbit to snout 3.8; horizontal orbital diameter 2.2; interorbital distance 2.7; distance between vomerine teeth and parasphenoid tooth patch 0.6; snout to fore limb 15.8; distance separating internal nares 2.2; distance separating external nares 2.7; snout projection beyond mandible 1.2; snout to posterior angle of vent 58.2; snout to anterior angle of vent 55.0; axilla-groin length 34.2; fore limb length 10.8; hind limb length 12.2; width of right hand 3.8; width of right foot 4.6.

Coloration in alcohol: ground color of dorsum of head and trunk uniform blackish brown overlain by a single row of large white anastomosing patches on either side (Fig. 1), most conspicuous in neck region and over shoulder. White patches dorso-lateral in position, each larger than eyes, the first patch located immediately posterior to eye on either side, other patches extending to level of sixth costal fold on left, ninth on right side, one patch located immediately dorsal to insertion of right hind limb.

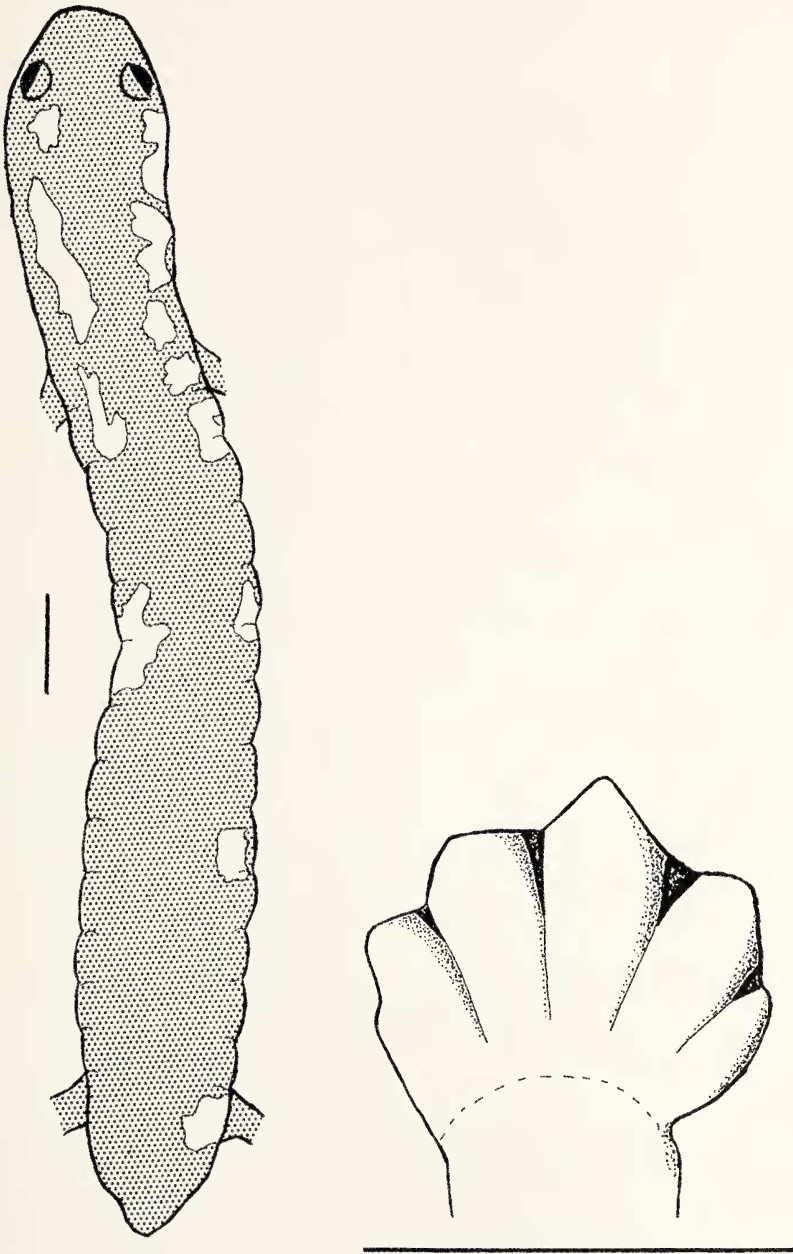


Fig. 1. Left: Color pattern of the holotype (BM 97.11.12.22) of *Bolitoglossa phalarosoma*; Right: Left foot of *B. phalarosoma* (MLaS 6). Lines equal 5 mm.

Markings absent on mid-dorsal line. Venter uniform dark brown, only slightly lighter than dorsum; gular region uniform brown, lighter than trunk venter. Limbs uniform dark brown. Post-iliac spots only faintly indicated.

VARIATION: Pertinent information concerning the male paratype follows: vomerine teeth 10-11; maxillary teeth 16-14; premaxillary teeth 3, piercing lip. Measurements in millimeters: head width 6.5; snout-gular fold (head length) 10.0; head depth at posterior angle of jaw 3.3; eyelid length 2.9; eyelid width 1.3; anterior rim of orbit to snout 2.9; horizontal orbital diameter 2.1; interorbital distance 2.6; distance between vomerine teeth and parasphenoid tooth patch 0.45; snout to forelimb 14.0; distance separating internal nares 1.7; distance separating external nares 2.1; snout projection beyond mandible 1.0; snout to posterior angle of vent 46.8; snout to anterior angle of vent 44.8; axilla-groin length 26.3; fore limb length 9.3; hind limb length 10.6; wide of right hand 2.8; width of right foot 5.1.

The paratype (in alcohol) is similar in color to the holotype but the ground colors are darker and the white patches less extensive. The first white patch on the right originates on the eyelid while the last right patch is anterior to the insertion of the fore limb. Only three large patches are present on the right side and two on the left. The most posterior patch is on the left and is located dorsal to the insertion of the fore limb.

An additional specimen from the Museo de La Salle, Bogotá, Colombia (MLaS 6) is assigned to *B. phalarosoma*. The only information concerning collecting locality is that the specimen is from "Antioquia," the name of both a Colombian city and Departamento. The individual differs from the type specimens in having a slightly wider head in proportion to body length and in lacking any white spots on the body. Pertinent information on the adult male follows: vomerine teeth not countable (inside of mouth damaged); maxillary teeth 26-25; premaxillary teeth 0. Measurements in millimeters: head width 7.5; snout-gular fold (head length) 12.0; snout to posterior angle of vent 55.8; axilla-groin length 31.5; fore limb length 10.9; hind limb length 11.8; width of right foot 5.1. In alcohol the dorsal surfaces are uniform blackish brown. The ventral surfaces of the head and trunk are a lighter grayish brown, although the ventral surface of the tail is darker.

RELATIONSHIPS

Bolitoglossa phalarosoma differs from all other South American members of the genus in its striking color pattern. In addition, it is easily distinguished from the *B. palmata* group by its longer snout and flat, fully-webbed hands and feet. The fully-webbed hands and feet also separate it from *B. adspersa*. It differs from *B. borburata* in having differently shaped hands and feet, fewer maxillary teeth, and a narrower head. The fully-webbed salamanders of the Amazon drainage, tentatively

assigned to *B. altamazonica*, are smaller and have shorter snouts. Several undescribed South American forms differ strikingly from *B. phalarosoma* in characters associated with webbing and coloration. There appears to be no close relationship between *B. phalarosoma* and any other South American species.

Several species of *Bolitoglossa* are known from southern Central America. *B. phalarosoma* differs from the large *B. lignicolor* in size, color pattern, and in having a much narrower head; from *B. striatula* in color and in having a narrower head; from *B. colonneae* in color, in having maxillary teeth, and in lacking the dermal interorbital ridge; from *B. arborescendens* in color, in smaller size, and proportions; from *B. flaviventris* in color, particularly ventral color, in smaller size, in proportions, in having fewer vomerine teeth, and in characters of the webbing of hands and feet. The specimens from Medellín were called *Oedipus platydactylus* (= *B. platydactyla*) by Dunn (1926), but there are numerous differences between *B. phalarosoma* and *B. platydactyla*, including size and proportional differences, and differences associated with the webbing of the hands and feet. *B. platydactyla* is a larger species that has a proportionally wider head. The web is fuller in *B. phalarosoma*, the foot flatter, and the digits are less demarcated. *B. platydactyla* has a dark ground color and a solid dorsal band of orange to orange-brown with a few irregular spots of ground color showing through. No band is present in *B. phalarosoma*, and the whitish color that is present is spotted on the dark ground color. Little evidence can be seen of relationship of *B. phalarosoma* to any of the above species.

Some evidence is seen of a relationship between *B. phalarosoma* and *B. alvaradoi*, a species known only from San Carlos, Provincia de Alajuela, and Moravia de Chirripó, Provincia de Limón, Costa Rica. The species are similar in basic color pattern, although *B. alvaradoi* has larger patches of color which are more extensive and less regularly placed than in *B. phalarosoma* (see Taylor, 1954, fig. 2). The extent of webbing and shape of the hands and feet are similar in the two species. Several differences between the species indicate that the relationship is not close. *B. alvaradoi* is a larger species with a wider head, longer limbs, and more maxillary teeth (proportional to snout-vent length). Five specimens of *B. alvaradoi* ranging in size from 46 to 77 mm. in snout-vent length have a total of from 59 to 89 maxillary teeth (versus 30 to 51 in *B. phalarosoma* at from 46.8 to 58.2 mm. snout-vent length). In two animals of comparable size the head is wider in *B. alvaradoi* (7.2 mm. at 46 mm. snout-vent length) than in *B. phalarosoma* (6.5 mm. at 46.8 mm. snout-vent length). Color serves as an indicator of relationships in other genera of salamanders (*Desmognathus* and *Plethodon*). On the basis of similarity of color and shape of hands and feet we believe *B. phalarosoma* is closer to *B. alvaradoi* than to any other species.

THE STATUS OF *Geotriton andicola* POSADA ARANGO

In 1909 Posada Arango described a new species of salamander, *Geotriton andicola*, from Colombia. The description contained no designation of a type or a type locality, although the paper was addressed from Medellín, Colombia. None of the material examined by Posada Arango is extant, and there is no record of anyone examining the material subsequent to publication of the description. Posada Arango described adult (66 mm. snout-vent length) *andicola* as being an intense and uniform black dorsally with some whitish spots on the venter; the young were bronze dorsally, black on the sides, and reddish on the throat. The species was compared only with *Geotriton fuscus* (= *Hydromantes italicus*) from Italy and the comparison dealt only in generalities, although the foot of *andicola* was said to resemble closely that of the Italian species. Apparently Posada Arango was unaware of the earlier description by Peters (1863) of *Spelerpes* (*Oedipus*) *adpersus* (= *Bolitoglossa adpersa*) from Bogotá, Departamento de Cundinamarca, Colombia, because he made no mention of it.

Since several species of *Bolitoglossa* occur in Colombia, we have attempted to assign the two available names, *adpersa* and *andicola*, to the appropriate populations. The syntypic series of *B. adpersa* was examined by Brame at the Berlin Museum, and the salamanders from the immediate vicinity of Bogotá are all assignable to that species. Dunn (1926) considered *andicola* to be a synonym of *adpersa*, but in 1944 he referred certain salamanders from the Bogotá area to *andicola* and presented a key for distinguishing the two species. The *andicola* of Dunn (1944) was said to be a larger form (males to 70 mm., snout-vent length), with a uniform dark dorsal color pattern or a broad, light dorsal band, and two costal interspaces between appressed limbs. According to Dunn, *adpersa* was smaller (male to 53 mm., snout-vent length, female to 70 mm.) with a color pattern consisting of light dashes or streaks on a dark background, and four to five costal interspaces between appressed limbs.

We have examined the salamander material in the collections of the Instituto de Ciencias Naturales and the Instituto de La Salle, both of Bogotá, including material seen by Dunn, and are unable to recognize more than one species in the Bogotá area. Large specimens of *adpersa* occasionally lack the characteristic streaked color pattern and appear uniformly dark dorsally. Posada Arango made no mention of a broad, light dorsal band, nor have we seen any specimens from the Bogotá area with such coloration. The number of costal interspaces between appressed limbs is highly variable in *adpersa* and is related to both age and sex, ranging from two to five in a given population. Large adult males tend to have longer legs than females of the same size, and males and females from the same locality may have two and four costal interspaces between appressed limbs, respectively. Adult size in *adpersa* varies from region

to region. The *adspersa* from San Miguel and Tequendema Falls near Bogotá (called *andicola* by Dunn) are very large, (63 to 69.1 mm. snout-vent length in four specimens) but large *adspersa* also occur in the Monserrate-Arrayán region and are similar to smaller *adspersa* in all characters except size. Uniform dark dorsal coloration is rare in both large and small *adspersa*, although uniformity of color pattern (black) is seen in most specimens from Páramo de Palacio, near Bogotá. The salamanders from the Bogotá area assigned by Dunn to *andicola* are, in our opinion, large individuals of *B. adspersa*.

Several species other than *adspersa* occur in Colombia. Of these, only one attains a size as large as that attributed to the species described by Posada Arango. Nicéforo María (1958) presented a photograph of a specimen assigned by him to *B. andicola*. We have examined his material and find it represents an unknown species to be described by the authors at a later date. Members of this species are large (exceeding the size given by Posada Arango for *andicola*), are uniformly black with no whitish markings, and have fully webbed feet.

B. adspersa occasionally exceeds the size of the specimens measured by Posada Arango. Posada Arango's color description fits some large *adspersa*, although *adspersa* is usually dark brownish black with extensive streaks or stripes of bronze. A small number of individuals are uniformly black. There is no sign of reddish color on the throat or other ventral surfaces in young specimens. Whitish spots are occasionally found but they are lateral in position and are not common ventrally. The foot of *andicola* was said to resemble that of *Hydromantes italicus*. The foot of *adspersa* is not fully webbed and approaches the condition seen in *H. italicus*.

None of the several smaller species that occur in Colombia fit Posada's color description of *andicola*. *B. phalarosoma*, in addition to being smaller and having a different color pattern, also has a different foot shape. Examination of all extant Colombian salamander material leads us to consider *Geotriton andicola* Posada Arango as a synonym of *Bolitoglossa adspersa* Peters, on the basis of coloration in some larger specimens of *Bolitoglossa adspersa* (especially from San Miguel) with similar maximum size, and similar foot shape.

ACKNOWLEDGMENTS: Alice G. C. Grandison and J. C. Battersby of the British Museum of Natural History; Fred Medem of the Instituto de Ciencias Naturales, Universidad Nacional de Colombia; and Hermano Nicéforo María, Instituto de La Salle, Colombia, have arranged loans to us of valuable specimens and we thank them for their assistance. We are grateful to Jay M. Savage for reading the manuscript and offering his criticism.

SUMMARY

A new Colombian species of plethodontid salamander, *Bolitoglossa phalarosoma*, is described from material long confused with *B. platydactyla*. The new species is apparently related neither to *B. platydactyla* and its relatives of Mexico and northern Central America nor to any South American members of the genus. The closest relative of *B. phalarosoma* appears to be *B. alvaradoi* of Costa Rica.

The status of *Geotriton andicola* from Colombia is discussed, and the name is placed in the synonymy of *B. adspersa*.

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CONTRIBUTIONS ★ IN SCIENCE ★

NUMBER 50

FEBRUARY 26, 1962

GROWTH MEASUREMENTS OF YOUNG CAPTIVE ATLANTIC SEA TURTLES IN TEMPERATE WATERS

By DAVID K. CALDWELL¹

ABSTRACT: Rapid growth is indicated for all young sea turtles.

Growth data are presented for the first three years of life for green turtles, *Chelonia m. mydas*, and these results, coupled with findings from published sources, are used to postulate an age at first maturity for this species of approximately 13 years in temperate waters and some eight years in tropical seas.

Limited growth data on hatchling and/or juvenile individuals are included for the hawksbill, *Eretmochelys i. imbricata*; for the loggerhead, *Caretta c. caretta*; and for the ridley, *Lepidochelys kemp*i. It is postulated that the loggerhead may mature at approximately 6 or 7 years of age in temperate seas.

Captive green turtles were conditioned to respond to a bell signaling feeding time.

A ridley turtle was shown to continue normal activity, which includes considerable swimming, even though it refused to eat for the five months preceding death.

During the past few years, growth records have been accumulated, covering varying lengths of time, on captive sea turtles of several species. All of the results are surprisingly consistent in indicating rapid growth, although they vary due to the circumstances of each individual's captivity and with the species concerned. These findings are now presented to reinforce the premise that young sea turtles grow rapidly in captivity. The results may be applied, with reservations, to growth rates under natural conditions.

One of the more perplexing problems in the study of sea-turtle natural history has been the scarcity of records of small turtles seen in nature as compared with adult or sub-adult individuals. As I suggested in an earlier paper (Caldwell, 1960: 6), such a phenomenon is undoubtedly in part a result of biologists not looking in the right places, but also of much more rapid growth rates in young sea turtles than once was supposed.

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METHODS

All measurements were made in accord with Carr and Caldwell (1956: 4). Hereafter, the term "length" refers to carapace length, and the term "width" refers to carapace width. Original weights and measurements were made in pounds and grams, inches and millimeters, or combinations of both. Where appropriate, all were converted to the metric system for this paper using 454 grams to the pound (28.4 grams to the ounce) and 25.4 millimeters to the inch.

The water temperatures in the oceanarium tanks closely approximated those in nature (at the site of captivity) as the water was continually being pumped in from the nearby sea.

An effort was made by the aquarists in charge to approximate the known natural diet of the turtles.

Lengths at first maturity noted in this paper are based on the lengths of the smallest nesting females so far recorded for the given species. Males may mature at a different size.

SPECIES LIST

Atlantic Green Turtle, *Chelonia mydas mydas* (Linnaeus)

Carr and Caldwell (1956: 12) summarized the meager knowledge of growth rates for Atlantic green turtles. Reasonably long-term data are now added on a number of very small green turtles. Using these data, and information taken from the literature, an age at maturity (length of 35 inches, *vide* Carr and Ogren, 1960: 8) of no more than 13 years, and perhaps little more than half of that, can be postulated—depending on latitude.

Twenty-five green turtles, each approximately 50 mm. in length at hatching, and from the same initial hatching at Tortuguero, Caribbean Costa Rica, were kept under various conditions of captivity and diet—at the Seahorse Key laboratory at Cedar Key, and at Florida's Gulfarium, both on the northwestern coast of Florida, and at Marine Studios on the northeastern coast of the state. It was noteworthy that despite variation in conditions of captivity, the mean results at comparable ages were remarkably similar. The similarity of these findings adds weight to the use of such data as an order-of-magnitude representation of natural growth for young sea turtles at a given latitude.

All of the turtles were fed on a cut-fish and shrimp diet (in varying proportions at the different locales of captivity) which is believed by aquarists, using trial and error methods, to represent closely the natural diet of green turtles of this size, although older individuals are herbivorous. Very young captive green turtles refused plant food. Four of the individuals were maintained almost three years before circumstances demanded that they be released into a large fenced-off bay where they could no longer be captured for measuring. Individuals maintained elsewhere were like-

wise released, or died for reasons other than diet deficiency before the end of three years.

GROWTH RATE BASED ON LENGTH: Combining all of the results, and interpolating the irregularly-collected data to one-year intervals, an estimated rate of length increase was obtained for the nearly three years of the experiment. These estimations are: 100 mm. the first year, 115 mm. the second year, and 115 mm. the third year. Turtles larger than these at capture in the northwestern Gulf of Mexico (estimated from these data to have been three to four years old), and also fed on cut-fish and shrimp, grew only about 50 mm. per year.

Carr and Caldwell (1956: 12) reported, on the basis of one fragmentary tagging return, that one sub-adult green turtle, living under natural conditions on the northwest coast of Florida (near Cedar Key), could have increased its length a minimum of one inch in approximately three warm summer months, or a maximum of $6\frac{1}{2}$ inches. The great range in possible growth for this turtle is a result of the loss of the tag (although the turtle was clearly identifiable as having been one of those tagged during the study) and these figures are maxima and minima based on the largest and smallest size that the turtle could have been at tagging (see Carr and Caldwell for a more detailed discussion of this recapture). The findings with the small turtles in captivity, noted above, show that there are about six warm months in which most of their yearly growth is made in these temperate latitudes, with most of that during the three warmest summer months. Using this six-month growing time as a point of departure, one may assume that the sub-adult turtle reported by Carr and Caldwell would have grown somewhere between two and 13 inches per year. Unverified findings on cabbage-fed captive turtles of this size, in approximately the same latitudes, reported to me by aquarists, indicate that the smaller figure is more realistic. Assuming therefore, an arithmetic (which my data indicate, and Hendrickson, 1958, assumes) two-inch increase in length per year after the third year, the smallest nesting female green turtle (35 inches in length) noted above would have been about 13 years of age. A logarithmic increase, which Dr. Archie Carr writes he believes may occur, would result in a somewhat earlier maturity in these temperate latitudes.

As I have frequently noted, the above findings are all based on green turtles reared in temperate latitudes, north of the usual breeding range of the species. Green turtles living in the perpetually warm waters of their more expected tropical range, or under warm-water controlled laboratory conditions, might be expected to grow significantly throughout the year, rather than having only approximately six months in which to do most of their yearly growing. If this is the case, then the tropical turtles should reach maturity at an even earlier age than the 13 years proposed for their temperate-living siblings. Schmidt's (1916) findings on tagged individuals of 5 to 45 pounds living in nature in the tropical Danish West Indies